Southern Pine Beetle

Guide for Predicting Timber Losses from Expanding Spots in East Texas

by

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Many southern pine beetle infestations (SPB spots) enlarge during warm months if no direct control is applied. Other spots are abandoned by emerging beetles soon after detection with little or no additional loss of trees. The extent of timber losses from spot expansion will depend on the initial size of the infestation and the density (basal area) of the stand. The following steps describe how to predict tree and dollar losses from spot spread over a 30 day period during summer months. This estimate is useful for making better control decisions.

1. Examine the spot to determine if trees with fresh SPB attacks (stage 1) are present. See USDA Agricultural Handbook 558 for details. If there are no fresh attacks, no additional spot spread is likely to occur and the spot will probably be inactive within 30 days.

2. If freshly-attacked trees are present, count or estimate the total number of active trees in the spot. Active trees include trees with fresh attacks (stage 1) as well as those with SPB larvae, pupae or new adults (stage 2).

3. Estimate the stand basal area (in ft^2/acre) at the active head(s) of the spot, using a 10 factor prism. (Stand basal area = basal area of pines + hardwoods.)

4. From Table 1 (on reverse side) determine the additional tree losses to be expected after 30 days. *This estimate does not include the trees already dead or currently infested with beetles.*

5. To estimate the dollar loss to be expected from spot expansion over the next 30 days, use the following formula:

Expected dollar loss = A x B x C

where:

A = additional trees killed from Table 1.
B = average volume per tree.
C = stumpage price per unit volume.

6. For a given spot, the value in Table 1 for "trees remaining active" is an estimate of the number of active trees to be expected at day 30. This value, when compared to number of active trees at day 0, indicates whether the level of beetle activity in the spot is likely to increase or decrease if no control is applied.

Example Of How To Figure Dollar Losses

Question: What are the tree and dollar losses to be expected after 30 days from a spot of 75 active trees in a uniform sawtimber stand of 150 ft^2/acre basal area if average volume/tree = 100 bd. ft and stumpage price = $250/MBF?

Answer: From Table 1, additional trees killed after 30 days = 62.

Additional dollar loss = (62 trees) x (100 bd. ft/tree) x ($0.25/bd. ft) = *$1550.*

In other words, if this spot is not controlled, the landowner can expect to loose 62 more trees in the next 30 days, valued at $1550. This loss is in addition to trees already infested or dead.

TABLE 1

Additional Timber Losses To Be Expected From Spot Growth Over 30 Days During Summer in East Texas[1]

Number of Active Trees At Day 0[2]		Total Stand Basal Area (ft²/acre)			
		20-60	70-110	120-160	170-210
		Predicted Value at Day 30			
5	Additional trees killed[3]	0	0	0	0
	Trees remaining active[4]	≤ 1	≤ 1	≤ 1	≤ 1
10	Additional trees killed	0	0	2	5
	Trees remaining active	≤ 2	≤ 2	4	7
20	Additional trees killed	0	5	12	18
	Trees remaining active	≤ 4	9	16	22
30	Additional trees killed	2	12	21	30
	Trees remaining active	8	18	27	36
50	Additional trees killed	9	24	39	54
	Trees remaining active	18	33	48	63
75	Additional trees killed	16	39	62	84
	Trees remaining active	30	53	76	98
100	Additional trees killed	24	54	84	115
	Trees remaining active	43	73	103	134

[1]To be used for evaluating spots in East Texas during months of June-October only.

[2]Number of stage 1 + stage 2 trees present when spot growth prediction is made.

[3]Predictions for "additional trees killed" derived from Texas Forest Service spot growth model (based on 1975 data):

$$ATK = [(0.000202\ IAT \times TBA) - 0.2211] \times 30$$

where ATK = number of additional trees killed by day 30
IAT = number of active trees at day 0
TBA = total basal area in ft²/acre

[4]Predictions for "trees remaining active" (TRA) based on SPB developmental rate of 37 days and formula:

$$TRA = ATK + \frac{7}{37}(IAT)$$

Table 5. Southern pine beetle economic evaluation and timber targets for the Bude Ranger District.

WITHOUT A PROJECT

AGE	HARV OBJ.	VOLUME LOST (MBF)	SPOT GROWTH RATE	VOLUME THREAT (MBF)	GROWTH RATE (%)	AGE AT HARV.	VOLUME AT HARVEST (MBF)	PRICE AT HARV.	VALUE AT HARVEST	PRESENT VALUE
15	P/I	19	2.63	50	8.8	15	54	$ 12	$ 649	$ 624
15	S/F	57	2.63	149	3.1	60	614	$ 172	$ 105585	$ 17381
35	S/I	19	.18	3	2.0	45	4	$ 172	$ 730	$ 474
35	S/F	57	.18	10	1.4	60	15	$ 172	$ 2544	$ 918
45	S/F	304	2.35	713	1.0	60	841	$ 172	$ 144600	$ 77203
55	S/F	302	1.41	425	.8	60	445	$ 172	$ 76467	$ 60433
60	S/F	76	2.63	199	.7	60	200	$ 172	$ 34422	$ 33098
TOTAL		833		1549			2172		$ 364997	$ 190131

VALUE OF THE VOLUME NOT SALVAGED (LOST) $ 76325

TOTAL VALUE LOST $ 266456

WITH A PROJECT

AGE	HARV OBJ.	VOLUME LOST (MBF)	SPOT GROWTH RATE	VOLUME THREAT (MBF)	GROWTH RATE (%)	AGE AT HARV.	VOLUME AT HARVEST (MBF)	PRICE AT HARV.	VALUE AT HARVEST	PRESENT VALUE
15	P/I	5	2.63	12	8.8	15	14	$ 12	$ 162	$ 156
15	S/F	14	2.63	37	3.1	60	153	$ 172	$ 26396	$ 4345
35	S/I	5	.18	1	2.0	45	1	$ 172	$ 183	$ 119
35	S/F	14	.18	3	1.4	60	4	$ 172	$ 636	$ 229
45	S/F	76	2.35	178	1.0	60	210	$ 172	$ 36150	$ 19301
55	S/F	76	1.41	106	.8	60	111	$ 172	$ 19117	$ 15108
60	S/F	19	2.63	50	.7	60	50	$ 172	$ 8605	$ 8274
TOTAL		208		387			543		$ 91249	$ 47533

VALUE OF THE VOLUME NOT SALVAGED (LOST) $ 19081

TOTAL VALUE LOST $ 66614

PROJECT BENEFITS[1/]

TARGETS

VOLUME REMOVED:	1874
VOLUME PROTECTED:	1162

1/ No benefit:cost evaluation is calculated for the ranger district. A complete benefit:cost evaluation for the Homochitto National Forest appears in tables 7 & 8.

Table 6. Southern pine beetle economic evaluation and timber targets for the Homochitto Ranger District.

WITHOUT A PROJECT

AGE	HARV OBJ.	VOLUME LOST (MBF)	SPOT GROWTH RATE	VOLUME THREAT (MBF)	GROWTH RATE (%)	AGE AT HARV.	VOLUME AT HARVEST (MBF)	PRICE AT HARV.	VALUE AT HARVEST	PRESENT VALUE
30	S/I	14	1.50	21	3.1	35	26	$ 150	$ 3860	$ 3051
30	S/F	43	1.50	64	1.7	60	109	$ 150	$ 16353	$ 4848
55	S/F	400	3.41	1366	.8	60	1429	$ 150	$ 214392	$ 169437
TOTAL		458		1452			1564		$ 234605	$ 177336

VALUE OF THE VOLUME NOT SALVAGED (LOST) $ 45760

TOTAL VALUE LOST $ 223096

WITH A PROJECT

AGE	HARV OBJ.	VOLUME LOST (MBF)	SPOT GROWTH RATE	VOLUME THREAT (MBF)	GROWTH RATE (%)	AGE AT HARV.	VOLUME AT HARVEST (MBF)	PRICE AT HARV.	VALUE AT HARVEST	PRESENT VALUE
30	S/I	4	1.50	5	3.1	35	6	$ 150	$ 965	$ 763
30	S/F	11	1.50	16	1.7	60	27	$ 150	$ 4088	$ 1212
55	S/F	100	3.41	341	.8	60	357	$ 150	$ 53598	$ 42359
TOTAL		114		363			391		$ 58651	$ 44334

VALUE OF THE VOLUME NOT SALVAGED (LOST) $ 11440

TOTAL VALUE LOST $ 55774

PROJECT BENEFITS[1/]

TARGETS

VOLUME REMOVED:	1030
VOLUME PROTECTED:	1089

[1/] No benefit:cost evaluation is calculated for the ranger district. A complete benefit:cost evaluation for the Homochitto National Forest appears in tables 7 & 8.

Table 7. Southern pine beetle economic evaluation for the Homochitto National Forest at 4% discount rate.

WITHOUT A PROJECT

AGE	HARV OBJ.	VOLUME LOST (MBF)	SPOT GROWTH RATE	VOLUME THREAT (MBF)	GROWTH RATE (%)	AGE AT HARV.	VOLUME AT HARVEST (MBF)	PRICE AT HARV.	VALUE AT HARVEST	PRESENT VALUE
15	P/I	19	2.63	50	8.8	15	54	$ 12	$ 649	$ 624
15	S/F	57	2.63	149	3.1	60	614	$ 150	$ 92080	$ 15158
30	S/I	14	1.50	21	3.1	35	26	$ 150	$ 3860	$ 3051
30	S/F	43	1.50	64	1.7	60	109	$ 150	$ 16353	$ 4848
35	S/I	19	.18	3	2.0	45	4	$ 150	$ 637	$ 414
35	S/F	57	.18	10	1.4	60	15	$ 150	$ 2219	$ 800
45	S/F	304	2.35	713	1.0	60	841	$ 150	$ 126105	$ 67328
55	S/F	703	2.55	1791	.8	60	1874	$ 150	$ 281078	$ 222140
60	S/F	76	2.63	199	.7	60	200	$ 150	$ 30019	$ 28864
TOTAL		1290		3001			3736		$ 553000	$ 343228

VALUE OF THE VOLUME NOT SALVAGED (LOST) $ 122085

TOTAL VALUE LOST $ 465312

WITH A PROJECT

AGE	HARV OBJ.	VOLUME LOST (MBF)	SPOT GROWTH RATE	VOLUME THREAT (MBF)	GROWTH RATE (%)	AGE AT HARV.	VOLUME AT HARVEST (MBF)	PRICE AT HARV.	VALUE AT HARVEST	PRESENT VALUE
15	P/I	5	2.63	12	8.8	15	14	$ 12	$ 162	$ 156
15	S/F	14	2.63	37	3.1	60	153	$ 150	$ 23020	$ 3789
30	S/I	4	1.50	5	3.1	35	6	$ 150	$ 965	$ 763
30	S/F	11	1.50	16	1.7	60	27	$ 150	$ 4088	$ 1212
35	S/I	5	.18	1	2.0	45	1	$ 150	$ 159	$ 103
35	S/F	14	.18	3	1.4	60	4	$ 150	$ 555	$ 200
45	S/F	76	2.35	178	1.0	60	210	$ 150	$ 31526	$ 16832
55	S/F	176	2.55	448	.8	60	468	$ 150	$ 70270	$ 55535
60	S/F	19	2.63	50	.7	60	50	$ 150	$ 7505	$ 7216
TOTAL		323		750			934		$ 138250	$ 85807

VALUE OF THE VOLUME NOT SALVAGED (LOST) $ 30521

TOTAL VALUE LOST $ 116328

PROJECT BENEFITS:	348984
TOTAL PROJECT COST:	31145
NET PRESENT VALUE:	317839
BENEFIT COST RATIO:	11.21
INTERNAL RATE OF RETURN:	> 400%
COMPOSITE RATE OF RETURN:	9.61%
TARGETS	
VOLUME REMOVED:	2903
VOLUME PROTECTED:	2251

Table 8. Southern pine beetle economic evaluation for the Homochitto National Forest at 7.12% discount rate.

WITHOUT A PROJECT

AGE	HARV OBJ.	VOLUME LOST (MBF)	SPOT GROWTH RATE	VOLUME THREAT (MBF)	GROWTH RATE (%)	AGE AT HARV.	VOLUME AT HARVEST (MBF)	PRICE AT HARV.	VALUE AT HARVEST	PRESENT VALUE
15	P/I	19	2.63	50	8.8	15	54	$ 12	$ 649	$ 606
15	S/F	57	2.63	149	3.1	60	614	$ 150	$ 92080	$ 3892
30	S/I	14	1.50	21	3.1	35	26	$ 150	$ 3860	$ 2555
30	S/F	43	1.50	64	1.7	60	109	$ 150	$ 16353	$ 1939
35	S/I	19	.18	3	2.0	45	4	$ 150	$ 637	$ 299
35	S/F	57	.18	10	1.4	60	15	$ 150	$ 2219	$ 371
45	S/F	304	2.35	713	1.0	60	841	$ 150	$ 126105	$ 41957
55	S/F	703	2.55	1791	.8	60	1874	$ 150	$ 281078	$ 186039
60	S/F	76	2.63	199	.7	60	200	$ 150	$ 30019	$ 28024
TOTAL		1290		3001			3736		$ 553000	$ 265681

VALUE OF THE VOLUME NOT SALVAGED (LOST) $ 122085

TOTAL VALUE LOST $ 387766

WITH A PROJECT

AGE	HARV OBJ.	VOLUME LOST (MBF)	SPOT GROWTH RATE	VOLUME THREAT (MBF)	GROWTH RATE (%)	AGE AT HARV.	VOLUME AT HARVEST (MBF)	PRICE AT HARV.	VALUE AT HARVEST	PRESENT VALUE
15	P/I	5	2.63	12	8.8	15	14	$ 12	$ 162	$ 151
15	S/F	14	2.63	37	3.1	60	153	$ 150	$ 23020	$ 973
30	S/I	4	1.50	5	3.1	35	6	$ 150	$ 965	$ 639
30	S/F	11	1.50	16	1.7	60	27	$ 150	$ 4088	$ 485
35	S/I	5	.18	1	2.0	45	1	$ 150	$ 159	$ 75
35	S/F	14	.18	3	1.4	60	4	$ 150	$ 555	$ 93
45	S/F	76	2.35	178	1.0	60	210	$ 150	$ 31526	$ 10489
55	S/F	176	2.55	448	.8	60	468	$ 150	$ 70270	$ 46510
60	S/F	19	2.63	50	.7	60	50	$ 150	$ 7505	$ 7006
TOTAL		323		750			934		$ 138250	$ 66420

VALUE OF THE VOLUME NOT SALVAGED (LOST) $ 30521

TOTAL VALUE LOST $ 96941

PROJECT BENEFITS:	290824
TOTAL PROJECT COST:	31145
NET PRESENT VALUE:	259679
BENEFIT COST RATIO:	9.34
INTERNAL RATE OF RETURN:	> 400%
COMPOSITE RATE OF RETURN:	12.45%
TARGETS	
VOLUME REMOVED:	2903
VOLUME PROTECTED:	2251

Appendix II

ALTERNATIVES FOR SOUTHERN PINE BEETLE CONTROL

Four alternatives are recommended for southern pine beetle control. The following discussion briefly outlines these alternatives (Swain & Remion 1980). For a more detailed description on conducting control procedures in a southern pine beetle suppression project refer to the Project Control Plan.

Alternative 1. Remove trees through salvage.

Salvage is the method most often used for stopping the growth of existing spots. This strategy involves removing a buffer strip of noninfested trees, all green infested and red infested trees, and if desired, the trees already killed by the beetles. Costs associated with removing uninfested trees are not charged to specifically designated SPB Project Control Funds since removing uninfested material is not needed for successful control even though it may be operationally desirable. The buffer strip should surround the recently attacked trees. It should be 40 to 70 feet wide for most active spots, while a 100-ft strip (and occasionally larger) may be needed for large, rapidly expanding spots. As a rule, the width of the buffer should not exceed the average height of the trees in the spot. The SPB spot should be carefully surveyed and all trees to be removed should be marked.

To implement this alternative the buffer strip should be cut first. All infested trees should then be cut. Vacated trees are cut last and are removed only for utilization purposes. All trees should be felled toward the center of the spot. The reason for this is to keep infested trees as far away from noninfested trees as possible. This reduces the chance of beetles killing additional trees.

Alternative 2. Piling and burning.

Unmerchantable or inaccessible southern pine beetle infestations can be suppressed by cutting, piling, and thoroughly charring the bark of infested trees. The entire bark surface must be thoroughly charred to insure effective control. The order of priority for cutting, piling, and burning infested trees, particularly in large spots, is the same for Alternative 1. Cutting a buffer strip is not recommended. To reduce the possibility of "breakouts", every effort should be made to locate and treat all green infested trees during the piling and burning operation.

Alternative 3. Cut-and-leave infested trees.

This is accomplished by felling a buffer strip and all infested trees toward the center of the spot. The purpose is to stop spot growth. Use of this method causes beetles to disperse at a time of year when this behavior is unnatural. This results in a reduction of mass attacked trees and spot

growth ceases. Cut-and-leave should only be used in the summer (May 1 - September 30), since these are the only months beetles are not dispersing. It should only be used on small spots, normally 50 infested trees or less.

Alternative 4. Chemically treat infested trees.

In this method, infested trees are felled toward the center of the spot, cut into workable lengths, and sprayed with lindane or Dursban® 4E. The purpose of this method is to kill the beetle population. To be effective, all bark surfaces must be sprayed. This involves turning the logs which becomes more difficult as tree size increases.

Forest Pest Management, Alexandria Field Office, Pineville, LA, should be contacted prior to the extensive use of chemical control for an update on latest restrictions or application procedures.

PRECAUTIONARY STATEMENT

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in their original containers under lock and key out of reach of children and animals, and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear appropriate protective clothing.

If your hands become contaminated with a pesticide, wash them immediately with soap and water. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove the clothing immediately and wash skin thoroughly. After handling or spraying pesticides, do not eat or drink until you have washed with soap and water.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicide from equipment, do not use the same equipment for insecticides or fungicides that you used for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary landfill dump, or crush and bury them in a level, isolated place.

NOTE: Some states have restrictions on the use of certain pesticides. Check your state and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Environmental Protection Agency, consult your county agent, state extension specialist or FPM to be

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or assistance, contact Forest Pest Management, Alexandria Field Office, Pineville, La., 71360, (Telephone: FTS 497-7280, or Commercial 318/473-7280).

REFERENCES

Anonymous. Setting control priorities for the southern pine beetle. Southern Pine Beetle Fact Sheet. Number 3. Bull. SH-FB/P. U.S. Department of Agriculture, Forest Service, Southeastern Area, State & Private Forestry; 1979. 2 p.

Billings, R. F.; B. G. Hynum. Southern pine beetle: Guide for predicting timber losses from expanding spots in east Texas. Circ. 249. Texas Forest Service; 1980. 2 p.

Connor, M. D. Biological evaluation of the southern pine beetle on the Homochitto NF in Mississippi. Rep. No. SA 80-2-3. U.S. Department of Agriculture, Forest Service, Forest Pest Management, Pineville, LA; 1979. 6 p.

Connor, M. D.; W. A. Nettleton. Biological evaluation of southern pine beetle on the National Forests in Mississippi. Rep. No. SA 81-2-25. U.S. Department of Agriculture, Forest Service, Forest Pest Management, Pineville, LA; 1980. 9 p.

Lorio, P. L., Jr.; R. A. Sommers. Use of available resource data to rate stands for southern pine beetle risk. In: Hazard rating systems in forest insect pest management: Symposium proceedings. Gen. Tech. Rep. WO-27. U.S. Department of Agriculture, Forest Service; 1981: 75-78.

Moore, L. M.; I. R. Ragenovich. Evaluation of the southern pine beetle infestation on the Homochitto National Forest, Mississippi. Rep. No. SA 76-2-3. U.S. Department of Agriculture, Forest Service, Forest Insect and Disease Management, Pineville, LA; 1975. 4 p.

Rogers, T. J. Evaluation of the southern pine beetle infestations on the National Forests in Mississippi. Rep. No. SA 76-2-21. U.S. Department of Agriculture, Forest Service, Forest Insect and Disease Management, Pineville, LA; 1976. 5 p.

Swain, K. M.; M. C. Remion. Southern Pine Beetle Handb.: Direct control methods for the southern pine beetle. U.S. Department of Agriculture Handb. No. 575; 1980. 15 p.

Terry, J. R.; J. F. Denniston; I. R. Ragenovich. Evaluation of southern pine beetle infestations on the Homochitto National Forest, Mississippi. Rep. No. SA 74-2-9. U.S. Department of Agriculture, Forest Service, Forest Pest Management, Pineville, LA; 1974. 7 p.

Terry, J. R.; D. H. Wilmore. Evaluation of southern pine beetle infestations on the Homochitto National Forest, Mississippi. Rep. No. SA 71-2-11. U.S. Department of Agriculture, Forest Service, Forest Pest Control, Pineville, LA; 1970. 5 p.

Twardus, D. B. Evaluation of southern pine beetle infestations on the National Forests in Mississippi. Rep. No. SA 78-2-7. U.S. Department of Agriculture, Forest Service, Forest Insect and Disease Management, Pineville, LA; 1977. 5 p.

Weiss, M. J.; P. H. Peacher. Evaluation of southern pine beetle infestations on the Homochitto National Forest, Mississippi. Rep. No. SA 76-2-6. U.S. Department of Agriculture, Forest Service, Forest Insect and Disease Management, Pineville, LA; 1976. 5 p.